



Modernization of Gas Monitoring Systems at the NCNR

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NCNR Gas Monitoring Systems

- Normal Air
- Irradiated Air
- Fission Products (Helium Sweep)
- Stack Air
- Confinement Building Tritium sampling
- Process Room Tritium sampling

NCNR Gas Monitoring Systems

- All effluent air is monitored for radioactivity
- Control Room notification of levels and alarms
- Monitoring 9 Tritium sample location's
- 1960's Equipment

Modernization

- Lack of spare parts and general obsolescence of the existing equipment
- NCNR approached the upgrades as a Reactor Life Extension Project to modernize the systems with mutually compatible equipment

Existing Gas Monitoring Systems

- Normal Air
 - Detects radioactivity released in the Confinement Building
- Irradiated Air
 - Detects radioactivity released in the reactor's Biological Shield at all the beam ports.
- Stack Monitor
 - Detects radioactivity going up the Stack

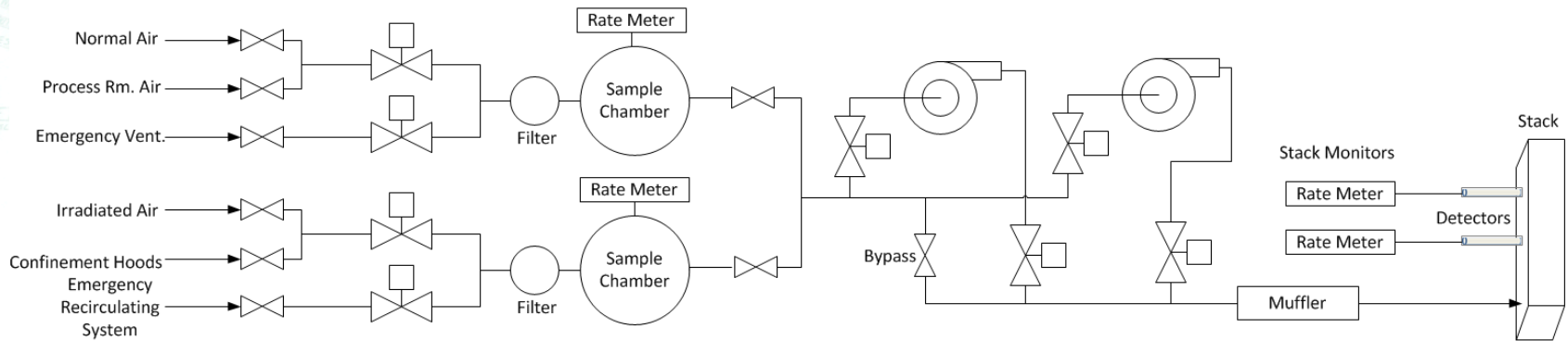
Existing Gas Monitoring Systems

- Equipment:

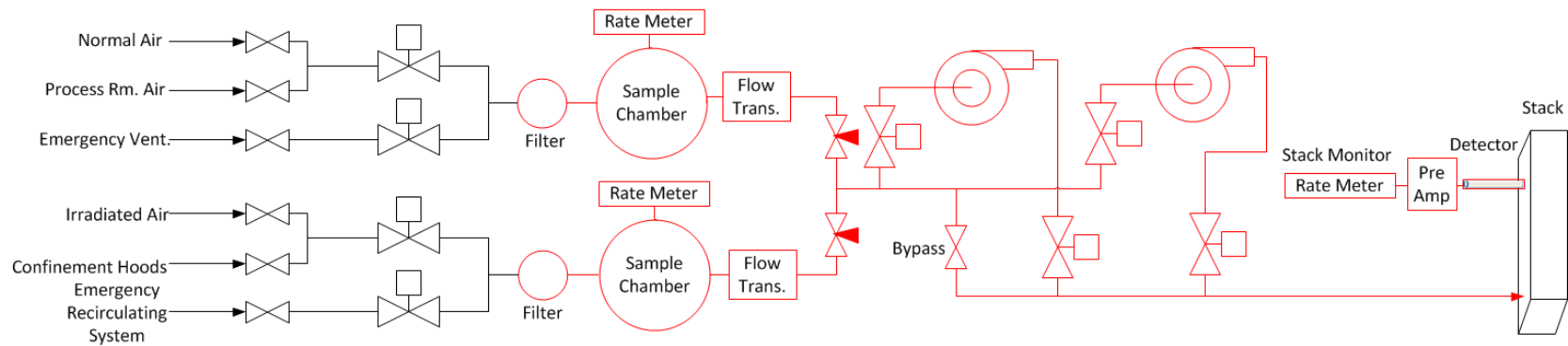
- Amperex G-M detectors
- Tracer Labs sample chambers and rate meters
- Fission Products and Stack Monitor have RemRad rate meters
- Range: $10-10^6$ cpm,
- Nuclide: Argon (41), Krypton (83, 85, 87, 88), Xenon (131, 133, 135, 137, 138)

Process Flow Diagram

Existing Effluent System



New Effluent System



Existing Effluent Systems

Existing Normal and Irradiated Effluent Systems

Normal Air Rate Meter

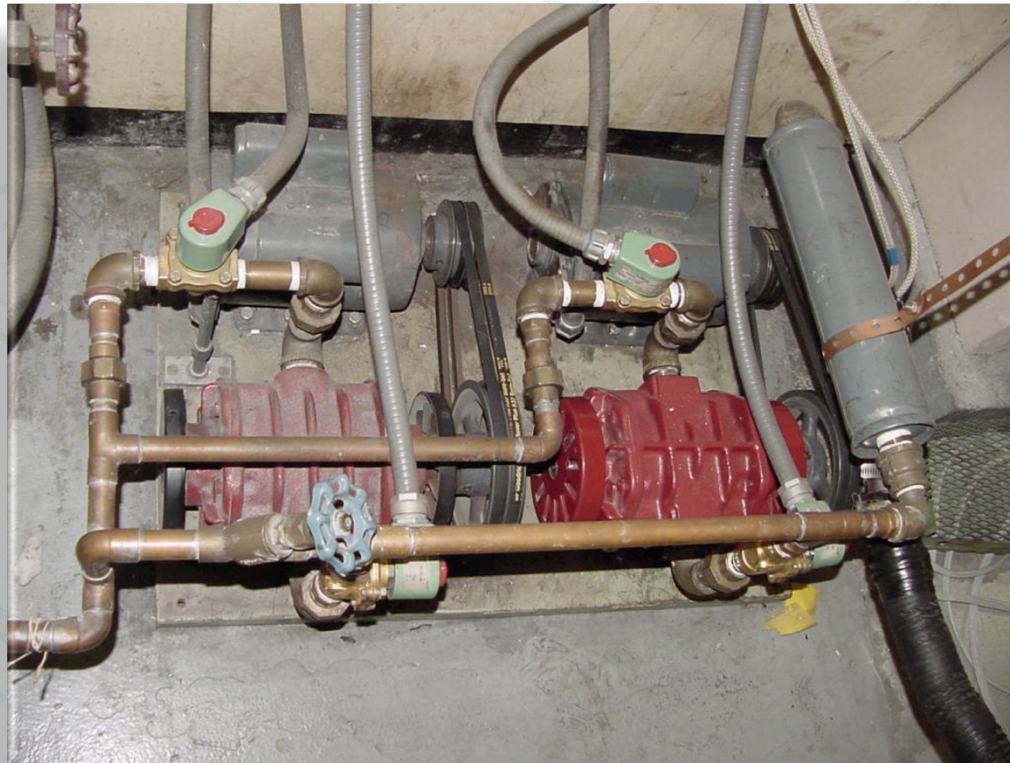
Irradiated Air Rate Meter

Sample Chambers



Existing Effluent Systems

Existing Effluent System Vacuum Pumps



New Gas Monitoring Systems

Detector Ranges:

Detector/Sampler	Xe-133 Current Mode w/Isotope Scale Factor	Kr-85 Current Mode w/Isotope Scale Factor
Detector Efficiency	2.24E+07 cpm/ μ Ci/ mL	7.19E+07 cpm/ μ Ci/ mL
Minimum Linear Range	1.47E-07 μ Ci/mL	4.57E-07 μ Ci/mL
Maximum Rated Range	1.57E+02 μ Ci/mL	1.96E+01 μ Ci/mL

Canberra Equipment:

- iR 7040 Ratemeter
- PA300E Preamplifier
- MD Plastic Scintillator Detector
- MG4A Sampler
- FA 200 Filter
- VT 4.16 Becker Vacuum pump

Note: The identification of any product or trade name does not imply endorsement or recommendation by the National Institute of Standards and Technology.

New Gas Monitoring Systems

Utilizing Intelligent Ratemeters

- Level 2 ECN evaluation prior to installation
 - Evaluated against 10 CFR 50.59
 - Health Physics review
 - Safety Committee review
 - Senior Management approvals

New Effluent Systems

Normal and Irradiated Effluent Systems

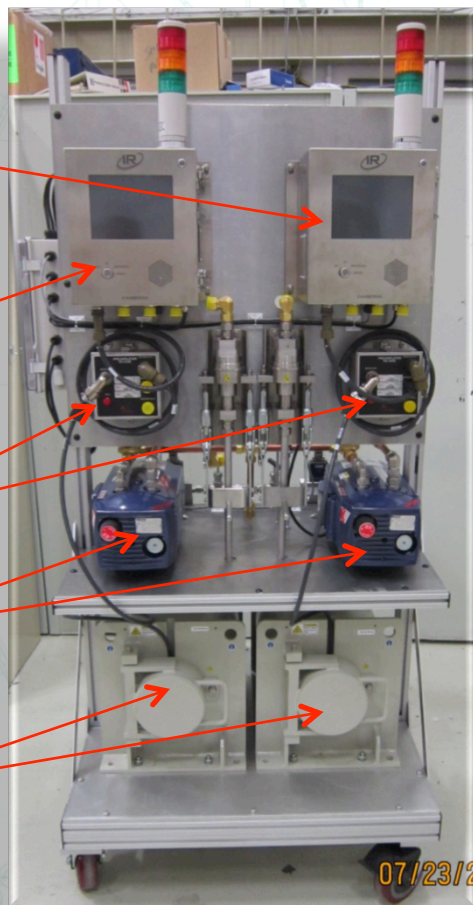
Irradiated
Air Rate
Meter

Normal
Air Rate
Meter

PreAmps

Vacuum
Pumps

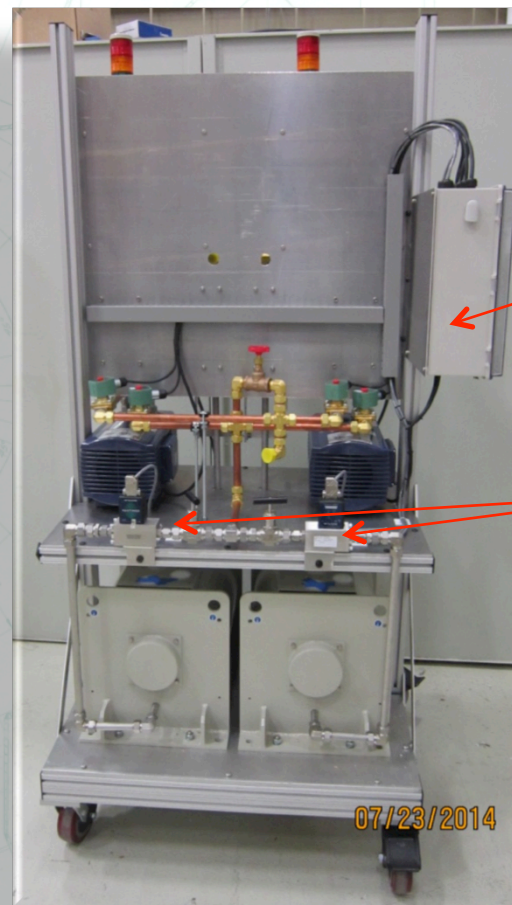
Sample
Chambers



Front View

Breaker
Box

Flow
Meters



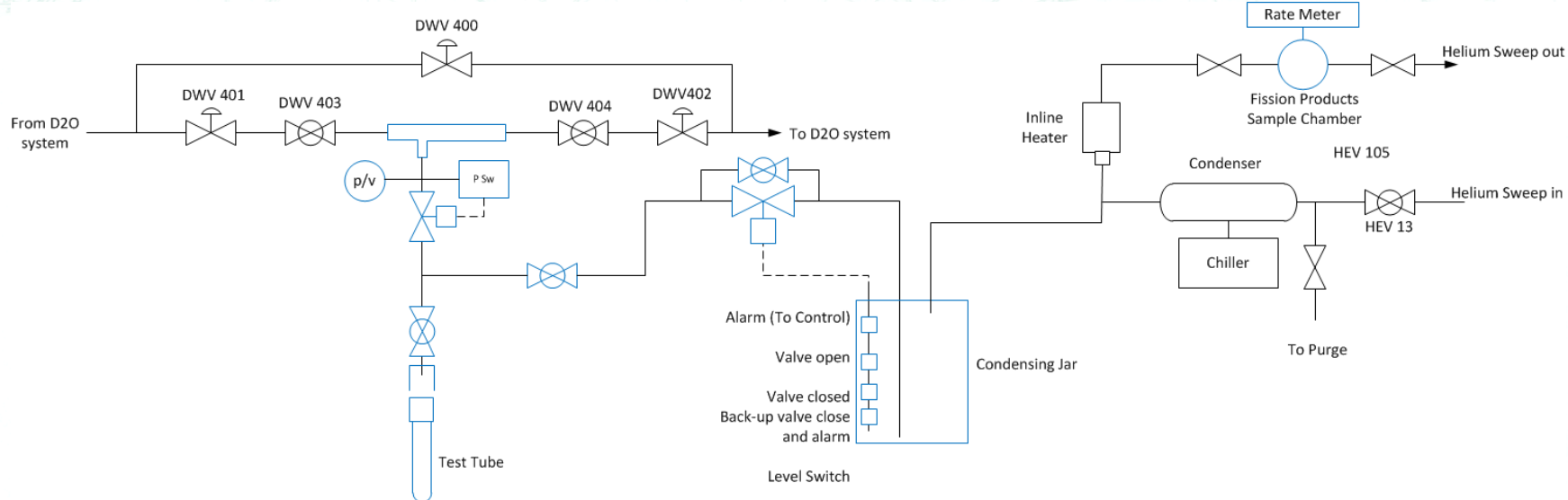
Rear View

Fission Products Monitor

Helium Sweep System:

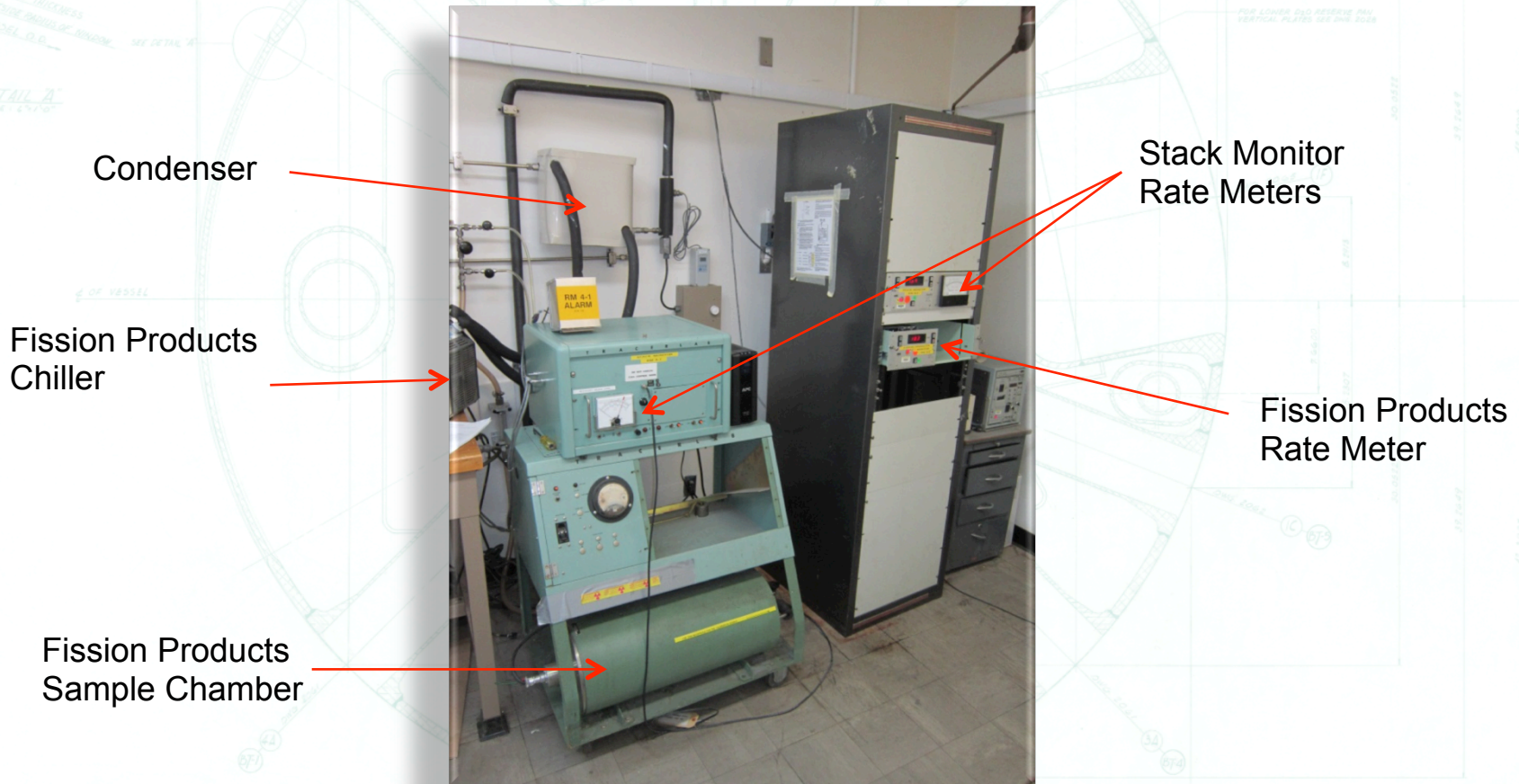
- Flows through the top of the reactor
 - Under positive pressure to keep light water out
 - Monitor detects damaged fuel elements
- System nuclides:
 - Ar-41
 - Kr-85m, 87, 88
 - Xe-131m, 133, 135, 138

Fission Products Monitor



Existing Effluent System

Fission Products and Stack Monitors



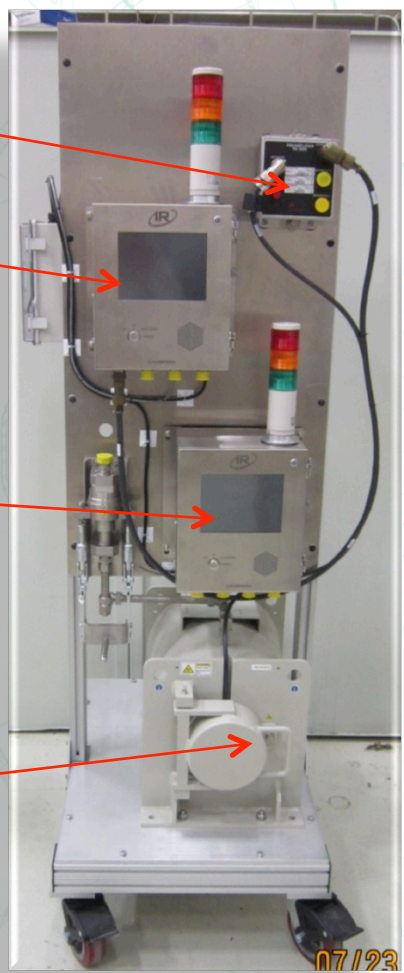
Stack Monitor Detector



New Effluent Systems

Fission Products and Stack Monitor

- Fission Products Pre Amp
- Fission Products Rate meter
- Stack Monitor Rate Meter
- Fission Products Sample Chamber



Front View



Rear View

Flow Meter

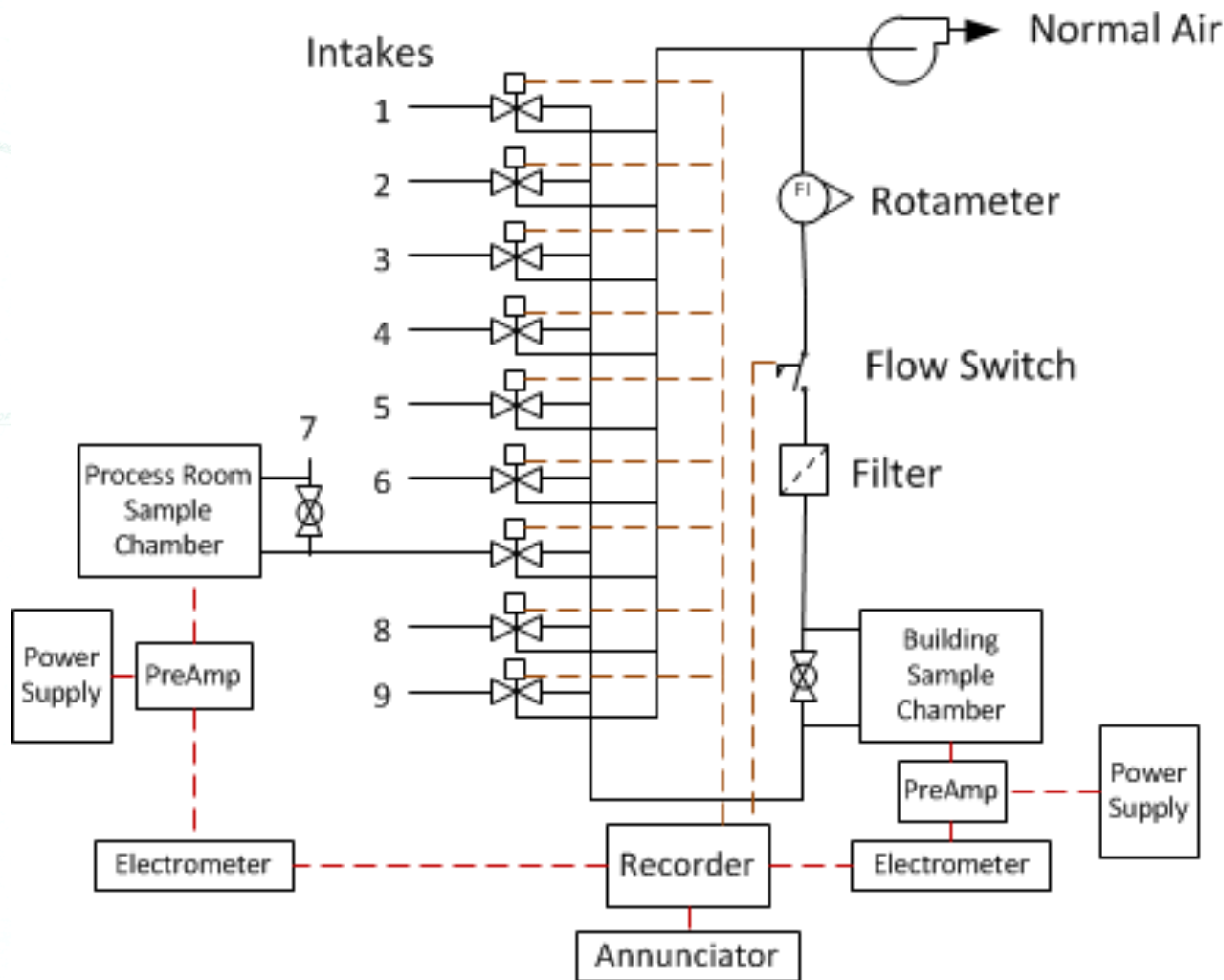
Tritium Monitoring Systems

- Detects Primary Heavy Water leakage
- Detects Tritiated Helium Sweep leakage
- Monitors airborne Tritium concentration during shut-downs
- Samples 9 Confinement Building locations
 - 3.5 Minute flush time per sample
 - Alarms between 1.25 to 150 DAC depending on location
- Continuous monitoring of the Process Room

Previous Tritium Monitoring Systems

- Problems
 - Lack of spare parts and general obsolescence of the existing equipment
 - Inadequate calibration equipment
 - Random false alarms
 - Inaccurate Rotameter and flow switch

Previous Tritium Monitoring Systems



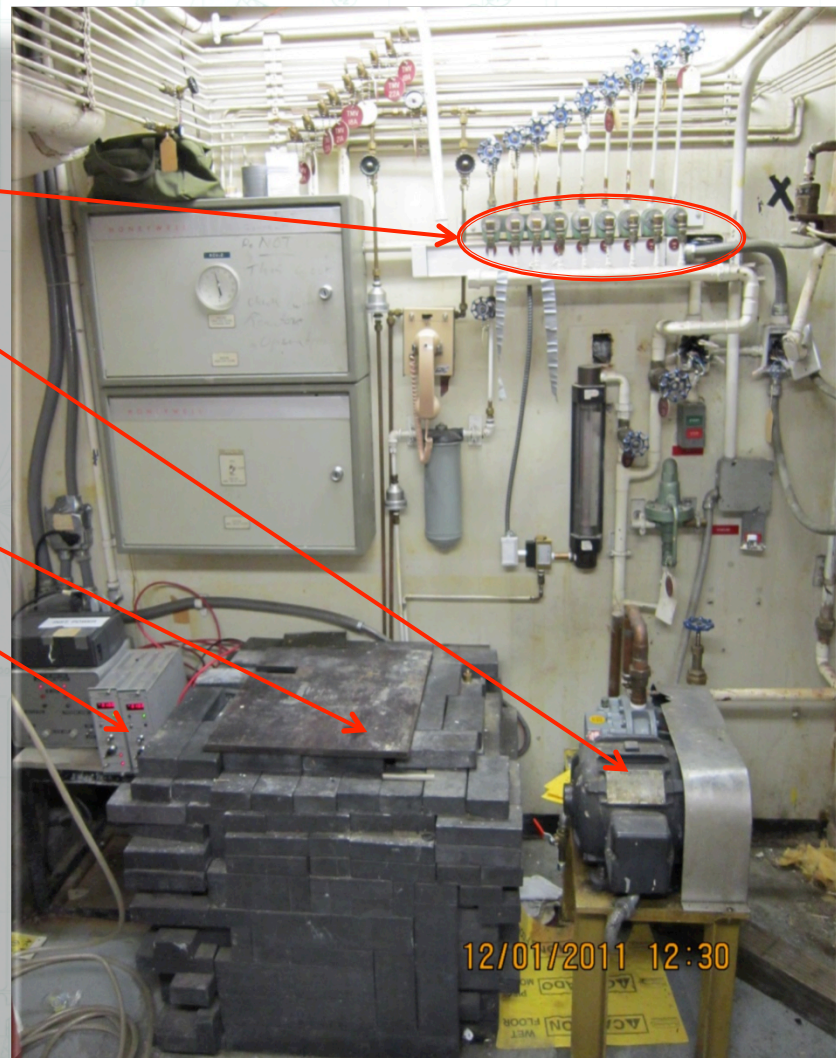
Previous Tritium Monitoring Systems



Control Room Recorder



Control Room Electrometers



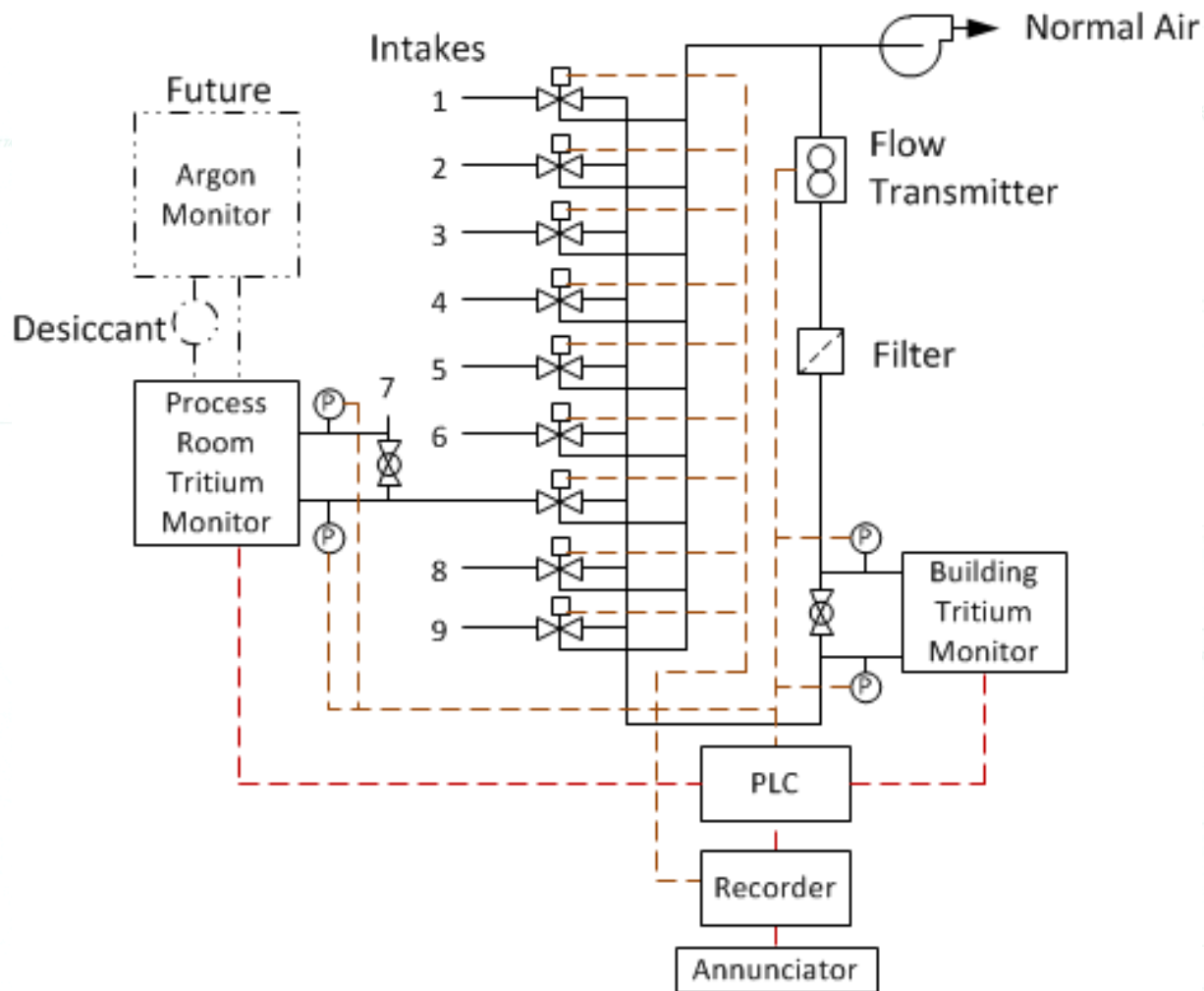
9 sample points

Vacuum Pump

Detectors behind Lead Shield

PreAmp

New Tritium Monitoring System



New Tritium Monitoring Systems



Control Room Recorder

Canberra TAM 100D
Monitors



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NCNR

Questions?

